Thermoelectric properties and microstructure of modified novel complex cobalt oxides Sr3RECo4O10.5 (RE = Y and Gd)

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Thermoelectric properties and microstructure of modified novel complex cobalt oxides $Sr_3RECo_4O_{10.5}$ (RE = Y and Gd)

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Thermoelectric properties from 300 to 1200 K and microstructure of novel complex cobalt oxides $Sr_3RECo_4O_{10.5}$ (RE = Y and Gd) have been investigated in terms of Ca and Ga doping at the Sr- and Co-sites, respectively. We found that the sample with RE = Gd shows a significant higher electrical conductivity (σ) than the RE = Y sample in the high temperature region above 500 K, while the Seebeck coefficient (S) of these samples remains almost the same over the whole measured temperature range. With Ga substituting for Co, S at temperatures above 700 K increases, and its values tend to increase with increasing Ga concentration. The power factor (σS^2) of the $Sr_3GdCo_{4-x}Ga_xO_{10.5}$ system is significantly enhanced and further improved by the substitution of Ca on the Sr-site due to a simultaneously increase in both σ and S. At 1150 K, the highest σS^2 value of $Sr_2CaGdCo_{3.9}Ga_{0.1}O_{10.5}$ sample attains about 60 $\mu Wm^{-1}K^{-2}$, which is 8 times larger than the $Sr_3GdCo_4O_{10.5}$ counterpart. Interestingly, microstructure shows a clear evolution of crystalline grains for the Ga and Ca dually doped-sample resulting in a substantial decrease of its porosity.

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